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The Monthly Review

Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

AUGUST 1937

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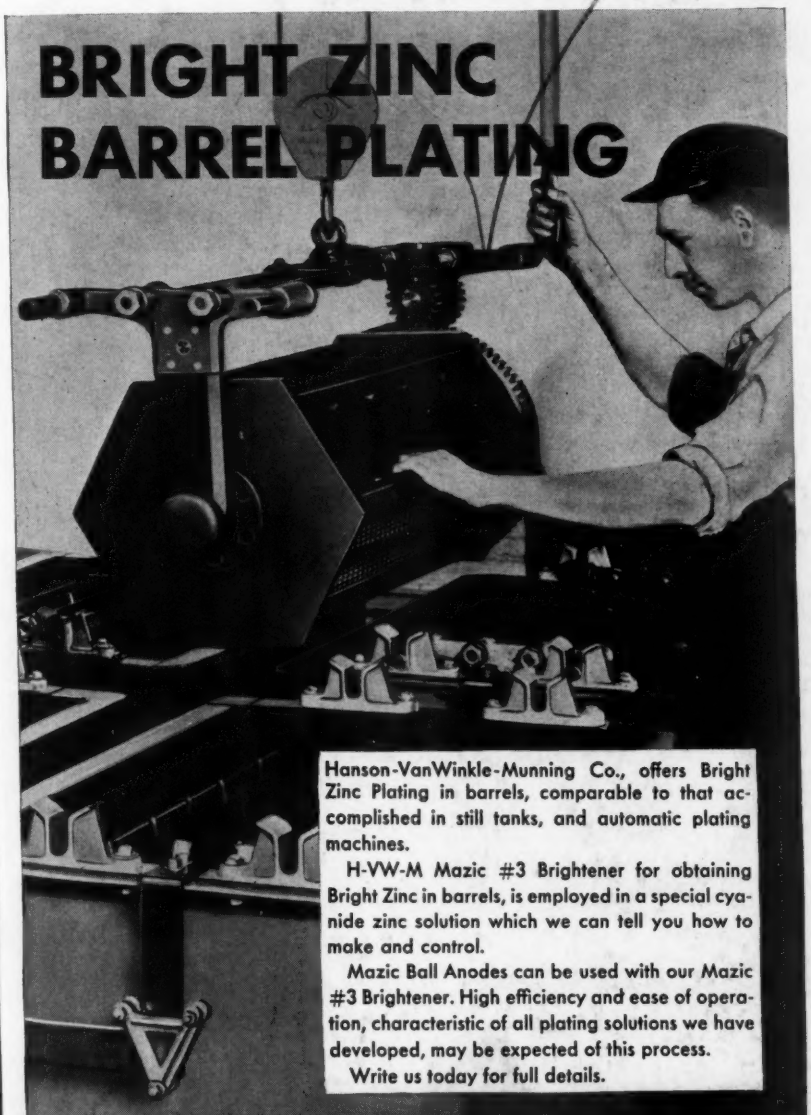
BRIGHT ZINC BARREL PLATING



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The Monthly Review

Published by the AMERICAN ELECTRO-PLATERS' SOCIETY

A Society for the Advancement of the Science of Electro-Plating

AUGUST 1937

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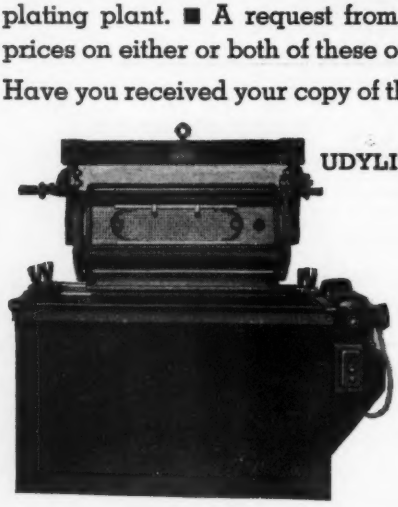

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Editorial

Now that the Silver Jubilee Convention has passed into history we might stop and ponder over some of the events that made it interesting and unique. There is always a sigh of relief when the final business session is concluded and the newly elected president declares the convention ended.

This period in the program on account of the nature of the business performed tends to make one "touchy" and even creates a feeling of resentment, especially on the part of those who are devoted to a certain course of action and see their hopes shattered by the opposition of others not in accord with their ideas.

One of the things we have always admired in the members of the A. E. S. is that in instances like this, good sportsmanship and the ability to give and take has always been manifested after the session ends. It is fitting therefore that we pay tribute once again to these men who, when defeated, subdue their own personal feelings that the work of the Society may continue without interruption or hindrance.

A few weeks ago we received letters from men prominent in two of our largest branches, who instead of showing a resentful spirit, have expressed the finer qualities within them by an earnest desire to help the organization grow and prosper in the coming year. We wish to thank these men for the fine qualities displayed and commend them for their spirit of cooperation as is evidenced by quoting from one of the letters received. In it the writer says "I think everything done at the convention was done for the best interests of the Society and that many changes will be made toward improvement and progress in the A. E. S."

"With a spirit like this from these two esteemable gentlemen both of whom we believe have always been inspired with the loftiest motives it is not too much to predict, that they will be

heard from again, when the Society needs men of ability and initiative to assume responsibility at some future meeting of the Society.

A few days after the annual meetings were ended several criticisms by some of our members were mentioned to us in a second hand manner. In analyzing them we believe the trouble lies in the inadequacy of our constitution in not being up to date enough to keep pace with the growth of the Society. Both the Research Committee and the Executive Secretary's Office are accused of acts of omission and commission. These criticisms may be true, but in the final analysis these offices have had to do many things by using ordinary common sense inasmuch as there was nothing in the present constitution to guide them.

In order to right this condition Past President F. J. Hanlon made the following motion at the New York Convention which was carried, "That the committee on Constitution Revision which was recently appointed by President E. Steen Thompson with Mr. T. F. Slattery as chairman be continued for one year more with the consent of the Supreme Society, to reconstruct the constitution and present it to the Supreme Society at its next convention, incorporating all the necessary amendments, etc. such as the previous committee was instructed to do."

When this committee presents the revised constitution for action by the delegates attending the Milwaukee Convention, we believe its adoption will end the uncertainty regarding methods of procedure, that has placed the Society's officers in an embarrassing position at times, and will create a better feeling on the part of those who are now inclined to be fault finding, without realizing the handicaps to be overcome by not having set rules with which to carry on the Society's business. It might be well to state that in addition to the chairman Mr. Slattery, this committee consists of Messers F. J. Hanlon, Oscar Servis, George Hogaboom, Walter Fraine and the Executive Secretary.

One of the unique features of the convention was the election of officers, every member of the Executive Board this year with the exception of the past president is new. Of course all have been prominent in the activities of the organization for several years and have done valuable work in their respective Branches. We are asking our entire membership to give these men united

and hearty support. President A. B. Wilson is no stranger in the A. E. S. he is president of Detroit Branch whose membership showed the largest increase during the past year, he is well qualified to direct our affairs and has the reputation of getting down to the root of things. F. J. MacStoker has capably handled the New York Convention and has been appointed chairman of the membership committee. R. M. Goodsell of Milwaukee Branch has been elected chairman of the Milwaukee Convention Committee and has been asked by President Wilson to head up the educational committee. Austin Fletcher, Secretary of Binghamton Branch was elected to the newly created office of Third Vice-President. His particular field of endeavor will be to create more interest and enthusiasm in the securing of exhibits from the branches and manufacturers for display at the annual convention.

Although this part of Mr. Fletchers position was not officially acted on by the convention it was suggested by the retiring executive board, and it is well known that the need for such work allotted to one particular individual really exists. We believe that with the enthusiasm and zeal with which he is gifted, Mr. Fletcher will do a real job through the support of our members.

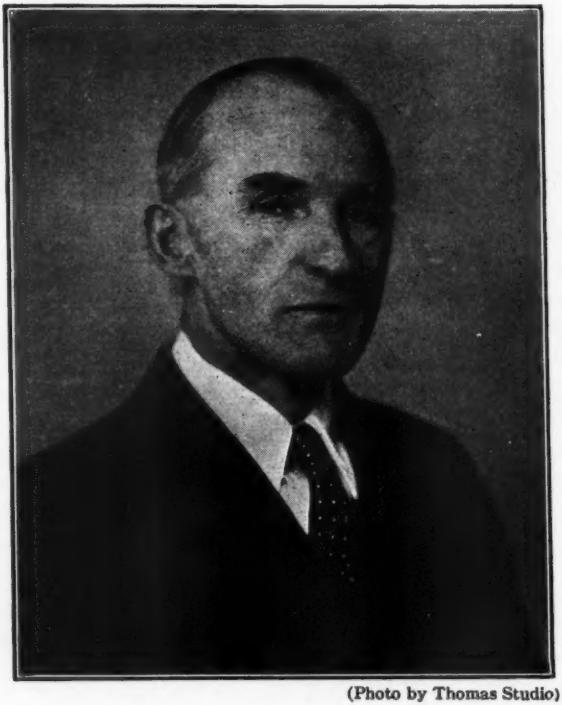
Mr. W. M. Phillips and Mr. T. Chamberlain have been appointed chairman and vice chairman respectively of the Research Committee by President Wilson.

Past President Horace Smith of Newark Branch has been asked to proceed with the preliminaries relative to the International Conference at Asbury Park in 1929, the privilege of selecting the Convention City two years in advance for obvious reasons was granted to Newark Branch at the recent convention in New York.

The Executive Board has also appointed the present incumbent to act as Executive Secretary for the coming year.

It is not too soon to look forward to the activities of the months ahead, therefore we are asking our members to be boosters. We have enjoyed a prosperous year, and our membership has shown a steady growth. The officers elected are able and efficient, anxious to serve to the best of their ability. Let us give them all the help we can. Keep in mind the 1938 convention in Milwaukee. The dates June 13, 14, 15, 16 at the Schraeder Hotel. Remember also to give Mr. Goodsell and the Milwaukee Convention Committee your heartiest cooperation as they make their plans for next year meetings.

Mr. W. F. Guilfoile of Waterbury Passes Away



(Photo by Thomas Studio)

Our readers will be sorry to learn that Mr. W. F. Guilfoile one of Connecticut's best known platers passed away on Friday, July 30 after a short illness at his home, 14 Oakland St., Waterbury. Funeral services were held on Monday, August 2 and burial was in Calvary Cemetery. A large number of beautiful floral pieces were sent to the home after Mr. Guilfoile's death became known, testifying to the love and respect in which he was held. In addition to his long connection with the A.E.S., during which time he was Secretary-Treasurer of the local branch, he was a familiar figure at all the national conventions and for many years was asked by each succeeding president to be Chairman of the Auditing Committee.

In fraternal circles Mr. Guilfoile was deeply interested in Sheridan Council 24, Knights of Columbus, in which he was second ranking officer. Over a long period he was financial secretary of Court Oregon, Foresters of America and was active in organizing and promoting the interests of St. Joseph's Temperance Society.

Most of our members will remember Mr. Guilfoile as a quiet, unassuming man, always cheerful, with a kind word for everyone. Our Society has lost a member who was faithful unto death.

The Waterbury Patent Button Co., his place of employment as plating room foreman for more than twenty-five years will mourn the loss of a valued and trustworthy employee.

All of us as individuals have lost a real friend, whose place it will be hard to fill.

We extend our sincere sympathy to Mrs. Guilfoile, Betty and William F. Jr., in the loss of a devoted husband and loving father.

Health Hazards *in the* Plating Industry

Prepared by the
CLEVELAND BRANCH
of the A. E. S.
Read by F. N. CARLSON
at the New York 1937 Convention

THE purpose of this paper is three-fold.

First: Promoting the health and efficiency of the employee.

Second: Calling attention to the economic and legal aspects arising from suits brought about through injuries.

Third: To create on the convention floor discussion that may bring out many points not covered by the material presented.

In preparing this paper, it was decided to bring out the many causes of injury and to touch on these briefly in order to permit ample time for discussion.

Aside from a workman's right to a clean, safe and healthy place in which to work, there is the further consideration of increased efficiency, lower production costs, and reduced insurance rates.

The losses resulting from occupational diseases over the nation are tremendous, as also are the opportunities for reducing them. Therefore, we feel justified in bringing to you a topic common to all, but still deserving of a great deal of consideration. Indeed, this is not only a business problem, but a social problem as well, and the employer who fails to discharge his obligation to provide the best possible working conditions for his employees is as surely headed for oblivion as one who fails to maintain quality, production schedule, or any other essential feature of his business.

Up to last year, all but two States had passed Workmen's Compensation Acts, of these only 17 grant compensation for occupational diseases. The early acts were concerned with awarding compensation for accidental injury while the importance of occupational diseases were largely ignored. There is, however, constant pressure being exerted to increase the employers' responsibility in this direction as is indicated by the constantly growing number of law suits instituted in behalf of the victims in our common law courts, and the magnitude of the generous verdicts awarded by juries in recent cases.

With the changing industrial and social pattern, it is imperative that the needs of labor be met in this respect.

SILICOSIS: Silicosis is perhaps the outstanding problem of this industry, and since it has been included in the compensable diseases, its importance can not be ignored. This is especially true in the polishing and buffing departments. While silicosis denotes the specific disease resulting from the inhalation of silica dust (Sio2), it is also applied in a broad, general way to a number of varieties of the disease contracted by inhaling particles of insoluable matter which lodge in the lungs. For the purpose of this paper, the term silicosis will apply to such pulmonary ailments as are the result of the inhalation of inert dust, attendant with the common operation of metal-finishing.

About 15% of all workers in industry are exposed to dust hazards which have deleterious effects on the respiratory system, their danger varying from mild irritation to silicosis and active tuberculosis.

Silicosis is characterized anatomically by a generalized fibrosis of the lung and clinically by shortness of breath, decreased chest expansion and a lessened capacity for work out of proportion to the objective physical findings.

It is often slow in development, hard to be recognized until well developed, and frequently when clearly diagnosed, is for all practical purposes, incurable. Therefore, it is extremely important to realize that the only certain remedy is prevention.

The first essential step in this direction is, of course, the provision of an adequate exhaust system to carry out the dust before it reaches the men. The second step would be to carry on the work in such a manner that no unnecessary dust is produced. Prevention should be extended to include periodical examination of the employee in order that no unfit person be kept under this hazard.

CLEANING: Under this heading, we wish to call attention to the irritation that frequently occurs when the operator on the cleaning tank makes it a practice to work with his sleeves rolled up exposing his forearm. The heated vapor arising from the cleaning vats serves to open the pores of the skin allowing the irritant alkaline particles carried over in the vapor to inflame the skin and pave the way for greater harm. When the operator is so

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unfortunate as to possess a tender skin, much loss of time can arise from this cause. The obvious remedy is to see that the tank worker keeps his sleeves rolled down regardless of the slight inconvenience this may occasion.

In addition to skin irrations, when freshly-made cleaners are put into operation, it sometimes occurs that the cleaner does not contain any soap compound and that the material cleaned is free from grease which would assist in producing a soap. Applying heat to a cleaner under these conditions, plus the agitation due to electrolysis causes minute particles of alkali to be carried over in the vapor, thus creating an alkali-laden atmosphere which is uncomfortably irritating. It has been found that the addition of a small amount of material such as beeswax or stearic acid to the cleaning vat will prevent the escape of alkali into the air.

NICKEL: While the subject of nickel itch is as old as the history of nickel-plating itself, it is a matter of conjecture as to which is the worst offender. The plating solution or the physical condition of the worker.

A term commonly heard today is that a person is "allergic," that is, he is susceptible to certain outside conditions which serves to set up a discord within his system. This sensitivity to the influence of the material to which he is allergic, is as much to blame for the trouble as the material itself or the conditions under which he works.

It has been noted that when a worker suffering from nickel itch has been transferred to other jobs, the ailment disappears rapidly.

In the treatment of this irritation, many of the ointments used in the lesser skin diseases are indicated. It should also be noted that such treatment as is indicated in cases of poison ivy will give relief.

Observing strict cleanliness while working around the nickel tank, will reduce this trouble to a minimum. If after a case is cleared up, the worker again becomes a victim of it, the only common sense remedy is to transfer him to some other work away from all contact with nickel solutions.

It has been observed that the general resistance of all workers to the commoner ailments of the plating room is greatly increased

when he makes it a practice to include in his diet much fresh fruit, such as oranges, apples, etc., as his budget will permit. It is a recognized fact that the fruit acids when assimilated by our bodies create an alkaline reaction which will go far in safeguarding us from the lesser complications of our profession.

Local discussion of this subject brought out the fact that some workers overcame their aversion to nickel and it was thought that this was due to the immunization through prolonged contact. It was proven, however, that the real cause was a correction of the man's internal condition through change of diet.

CHROMIUM: One of the latest hazards to be met with in the industry is that in the operation of chromium baths. While this is not due to any direct toxic condition arising from the material, its extreme corrosive properties result in severe damage to the eye, nose and skin.

Chromic acid in the form of dry dust or the result of spray from the plating operation may irritate the nasal tract to the extent of the formation of scabs and bleeding. Extreme cases of prolonged exposure have been known to result in the perforation of the septum or the division between the nostrils. Irritation may also occur within the eye; although ample warning is given the victim through the physical discomfort caused by the exposure. This may be readily relieved by bathing with water.

The effect of chromic acid on the normal skin is very slight. Its entrance into any abrasion or cut may lead to severe inflammation. In these cases prompt treatment at the time of contact will generally result in a minimum of irritation. If treatment is neglected, the sore bores into the surrounding tissue causing an ulcer with an accompanying hard top or scab. The application of a solution of sodium bisulphite will tend greatly to arrest this penetration through the neutralization of the chromium compound occluded within the wound. A compress of gauze saturated with this solution is the indicated method of treatment.

Due to the relative newness of the subject, the average physician has not had much experience in treating these conditions. The proper treatment is, therefore, a matter of prevention both in the selection of the worker and the subsequent instruction given him in regard to his personal cleanliness.

Adequate ventilation of the plating room will eliminate entirely

the hazard from spray, and it is important that the plater observe this in making new installations. The use of vaseline is highly recommended in protecting the nasal tract from such spray as may escape. To protect the skin of the hands and arms, applications of lanolin or wool-fat will reduce the chances of injury from contact with solutions. Of course it is taken for granted that the worker will be provided with rubber gloves and suitable means of protection from the solution and spray.

In handling the dry chromic acid when making up or replenishing a solution, the use of a respirator is recommended as here the worker comes in contact with the irritant in a highly concentrated form.

As is common with all other plating practices, cleanliness and good housekeeping will do more to reduce lost time at the tank than all methods of alleviation after the worker has been exposed.

LEAD POISONING: Lead poisoning is an insiduous ailment, inasmuch as it resembles cancer, and the difficulty of recognizing it in the early stages of its progress. There are four types of work in industry that promote lead poisoning. They are: Lead burning, lead pot heat treating (above 1600 degrees F.), lead plating, and paint making. Of the four, lead plating is the greater cause of lead poisoning. This is due in a large part, to the greater amount of fumes and lead salts with which the worker may come in contact.

The first symptoms of lead poisoning of the workman will be a general run-down condition of the body, and being more susceptible to colds, etc. This is accompanied by a loss of sleep, restlessness, nervousness, extreme irritableness, and constipation. The more advanced symptoms are: Black rings under the eyes, around the finger and toe nails, and around the gums at the base of the teeth. Sometimes small hard lumps appear on the body and back. These are accompanied in the later stages by severe cramps in the arms and legs lasting from several minutes to as long as an hour.

The only help that can be given the patient is a complete outdoor life, with plenty of rest, sunshine and good food. One of the best preventatives of lead poisoning is a clean, well-lighted and ventilated shop, where all dirt can be easily removed. Plating shops are notably lax in this respect, especially the smaller

jobbing shops. If managers could be made to appreciate what these improved conditions mean in increased efficiency and the great decrease in the number of rejects, they would realize that the better working conditions would save them ten-fold to say nothing of safe-guarding the workers' health.

However, this is only one step in the prevention of lead poisoning, and the manager can not emphasize too strongly the value of the workers' personal hygiene. The worker must scrub his hands with a brush using plenty of creosote, soap and water, before eating. The worker must take a shower and change all clothes before leaving the plant. The worker must drink large quantities of milk and guard against constipation. The worker must remember that lead poisoning is an internal ailment caused by lead entering the body through the nose and mouth. The worker must get lots of sleep and fresh air. The worker must not drink intoxicating beverages under any circumstances. The worker must see his doctor if he begins to feel run-down. The worker must keep dust down to an absolute minimum by wetting the floor before sweeping. When dust can not be kept down to a minimum, the worker must wear a respirator.

CYANIDE HAZARDS: We are all quite familiar with the old method of platers protecting their hands and arms with rags or canvas gloves when operating alkaline solutions. An improvement over this method was found by supplying each man with rubber gloves, boots and aprons. This equipment was exchanged by the employees of each shift. This practice cut down cyanide burns to a great extent, but did not eliminate all of the trouble. A better method is to furnish each individual with his own equipment. This has worked out very satisfactorily in one instance. Each new employee is supplied with a pair of rubber gloves, and the cost is taken out of his pay. However, as long as he continues to return an old pair, he receives a new pair in exchange, and no further charge is made. This encourages a more careful usage of this equipment than if issued indiscriminately.

In working with cyanide, again cleanliness is the most essential thing to practice. Each employee should be advised as to what he is working with, that there be no excuse for him to work with something blindly.

All drinking equipment should be so located as to preclude any contact with cyanide operations. A great potential danger exists where cyanide in any form is used in close proximity to acids or their solutions. The gases resulting from any chance mixture of the two are identical with the lethal material used in some States for executing criminals. The finality of its action should be sufficient evidence of the necessity for the isolation of these two chemicals.

Another source of trouble is the direct contact of cyanide or its solutions with the common wounds attendant with normal factory operations. In this respect, zinc cyanide solutions seem to be the greatest offenders due to their higher alkalinity, containing as they do both sodium cyanide and sodium hydroxide. Of course, copper, brass and cadmium are not to be forgotten.

The sores developing from contact with cyanide solutions are at first very insignificant in appearance, but soon advance to a stage where expert medical attention is advisable. A remedy that has worked well in one instance and that should be used only by a competent physician, consists of treatment with a 10% solution of carbolic acid. The first step in this treatment consists in the removal of the hard scab that covers the top of all neglected cyanide burns. The hole now exposed to view should be swabbed out with the 10% solution which will neutralize the cyanide and arrest further perforation. A subsequent washing with alcohol will neutralize the excess carbolic acid. Sores so treated should be kept clean and dry, and will heal very rapidly.

As in all other plating operations, ventilation of the cyanide tanks will do much to lessen the danger attendant with the inhalation of vapors carrying cyanide compounds. The attack from these fumes on the mucous membrane of the respiratory tract is somewhat similar to that resulting from the inhalation of vapors from the chromium plating operations.

It will be seen from the foregoing that a few general statements can be made which may be applied in common to all of the departments of this industry. In the order of their importance, they are:

First: Cleanliness or good housekeeping which is the result of instruction and the granting of ample time for its observance.

Second: Careful selection of workers as to their physical fitness and educating them in the proper handling of the materials with which they work.

Third: The problem of ventilation may be safely left to one of the many authorities now purveying equipment for this purpose and faithfully carrying out their recommendations.

Fourth: Providing working conditions as comfortable as possible, thus reducing the hazard that often has its origin in fatigue.

Safe and comfortable working conditions are now considered to belong to the ABCs of operating efficiency by the country's more progressive, industrial concerns, and it is gratifying to note that in their recent labor disputes, little or no criticism was directed specifically against the general working conditions.

There are, however, a great many concerns who have failed to fully recognized their responsibilities to their employees, and it is to them we address this paper.

CHAIRMAN STERLING: Mr. Carlson should be congratulated upon his presentation of this paper. It is an indictment of a great many plating plants, not only of the employers but of the employees as well, and if we could have this published and hung up in every department, I think it would be beneficial. Is there any discussion?

DISCUSSION

DELEGATE WILLIAM CASTELL (Anderson Branch): I should like to ask a question. I should like to know the general opinion about the hazards of solvents, in particular, and as to decreasing the use of gasoline.

MR. CARLSON: Since my paper was prepared and put into shape, I did not dare change it because I was afraid it would be messed up, but a clipping was handed to me yesterday by one of our members, calling attention to the opinions of doctors on that. It referred to a discussion at the recent medical convention in New York, and he wanted it incorporated in this paper. The clipping, however, was so brief and I had no information on it, so I did not feel capable of commenting on it. The clipping referred to the effects of solvents used in cleaning in industry. If I had been able to get more information on that I should have been glad to incorporate it in this paper, as it is a problem that requires some serious consideration in view of the popular use of this method of cleaning.

He mentioned some disease that occurred from it, a medical term. As I say, I did not feel capable of commenting on it, but it is something which I think should be looked into.

CHAIRMAN STERLING: Is there anything further?

MR. D. M. OVERCASH (Syracuse, New York): I should like to know if any of you have noticed that brunettes are less susceptible to skin rashes than blondes. That has been our experience, but we have had outstanding exception. Brunettes or dark-skinned people are less susceptible to these rashes than blondes are.

EXECUTIVE SECRETARY KENNEDY: I should like to suggest to the speaker, if it is possible, that he secure that paper, the clipping of which was handed to him, and incorporate it in his paper for publication in the REVIEW.

MR. CARLSON: I shall attempt to obtain it.

MR. D. BLOOMFELD: This is an interesting thing, which I had never thought of before, every light fellow I had in the department I had to let go, and now all my men are dark. I find that when you have sores, if you clean them out well and put powdered boric acid on them, they will heal very quickly, and there is no trouble. In fact, my men wash their hands in boric acid every night.

MR. CARLSON: The difference in effect on blondes and brunettes I should think would open up a vast labor market for our colored friends — they ought to be entirely immune.

MR. HOGABOOM: One of the things that the speaker referred to was silicosis. I wonder whether this is being given the amount of real study it should have, and whether the opinion is that silica is the cause of most of the trouble. This may go as far as to eliminate silica compound forming materials. When you are using any compound regardless of whether it is silica or whatever it may be, there are fine metallic particles, and the question arises whether it is not the metallic dust that enters into the bronchial tubes or the upper part of the lung that causes the trouble, rather than the silica. There was recently a case of what was designated as silicosis, and upon post-mortem examination it was found that a nut had settled down in the bronchial tubes of the man and had caused the trouble, and not silica. I am wondering whether the silica part is not being emphasized too much, and the metallic part forgotten, because when you polish you must remove some metallics and those metallics are very fine.

Your speaker spoke very well of lead poisoning, about polishing materials that contain lead, and how it can be caused through improper exhaust systems. The most important thing is to get a thorough exhaust system.

Now let us go to blondes. I do not know whether blondes or brunettes are more susceptible to the effects or hazards of the plating room, but I do know that in handling materials, such as silver vanity boxes, the girls who come from the southern Euro-

pean countries stain brass or silver much more readily when handling them than blondes do, and their perspiration will effect metals much more readily. I have known plants where you have to select girls so as to get away from the tarnishing of metals in packing.

MR. CARLSON: Speaking of silicosis, I applied that term to include those effects that resulted from the inert dust. In a discussion of silicosis there has been a wide-spread belief that silicosis was caused by a direct chemical combination of silica with the blood tissue. The opinion has been, and I substantiated it, that silicosis results from the silica particles entering the lungs and coating the tissues and becoming encrusted in tissue, and building up a mass of inert matter that does not function as lung tissue, and the same occurs when inert dust is breathed into the lungs. The body protects itself by simply embedding that in tissue which causes a congestion of the lungs when it becomes concentrated enough. That is the reason for the similarity. The two are used too indiscriminately; the one is so similar to the other, it is not entirely silica which is the case of the ailment. It is very similar to the condition that results from the inhalation of metallic particles or any other particles. It does not react readily with the body chemicals.

MR. HOGABOOM: I did not mean to make a distinction between silica so far as that is concerned and dust hazards, but there should be a distinction made between those that come in direct contact with silica dust alone and in the polishing game because it is a different thing. In one you have the straight silica and you have the reports, such as you quote from, of the effects of silica, but are they looking into the health hazard of the polisher and finisher and finding whether it is silica or metallic particles?

MR. CARLSON: That is what I was trying to get over. There is another name for it that I cannot pronounce, so I left it out of my paper.

MR. C. HUESSNER: (Detroit, Michigan): I think in regard to silica you might mention the fact that the insurance underwriters believe that the detrimental part of most of it is due to sand, because they have, in the last few years, practically rid the country of sand blasting, and a good many of the old type sand blasts may have had metallic particles coming out with the sand, as you have in the polishing room, but they still allow them to sand blast by not using sand. Good ventilation will practically eliminate the trouble, but underwriters feel that the really detrimental effect of silica is sand and not metallic particles. This paper comes at a time when it is rather interesting from another angle, and that is the American Standards Association has instigated work to be done on a National Health Code for the plating

room, which is being guided by Dr. Bloomfeld of the Industrial Hygiene Department of the United States Department of Health. I might say that the representatives on this Committee are very much interested in getting all the information that is available. It is not like some of our other committees, such as our Bureau of Standards Committee on Research on Plating, because I believe the industrial field is a more simple one, and the national department is more familiar with manufacturing than some of the other government departments. Fortunately, we have Dr. Blum of the National Bureau of Standards on this Committee, and anyone who might have some suggestions on ventilation or suggestions on eliminating things from the plating room and polishing room that are going to work hardships, I think should communicate with Dr. Blum because a vast amount of information and proof is needed in order for that Committee to accomplish what is expected of it in the next year or so.

It is generally conceded that whatever the American Standards Association will put out in this committee, will be accepted as the basic law by the states.

I believe that everyone here wants to protect their men with the right kind of ventilation.

The next question is, do you want them to tell you how much impurity of air is permissible, or do you want them to design for you the type of ventilation you should have? Questions of that type are important. Some feel that the ventilation should be designed while others feel that the code should include only how much impurity is permissible in the air — what is the limit. So anyone who has information of that type had better pass it on to Dr. Blum. It will certainly be appreciated.

DELEGATE HIRSCH: Mr. Hogaboom's point is well taken. It is quite different when you speak of these different things that have been referred to. We will take lead poisoning, for instance. It is quite different if you get lead poisoning from a plating room or in the painting industry. Another point is, to just what extent does it affect people. I happen to know of two cases in Philadelphia of lead poisoning in the paint industry, and they represent two extremes. One case is that of a young man who simply mixed paint for a painter to go out and use. He contracted lead poisoning and died at the age of thirty-three, simply from being in contact with lead paint. Yet, I know another man who was in the painting industry who retired, and twenty years afterward they found he had lead poisoning.

CHAIRMAN STERLING: Any further discussion on this?

MR. SODERBERG: Mr. Chairman, I am most particularly interested in this blond and brunette question, but I think we forgot the most interesting type of people, and that is the redheads.

As far as I remember, having read somewhat on this subject in literature, the redheads are particularly susceptible to these types of infections.

Another question that came up was about our colored friends that brought to mind another observation that has been made; namely, the sensitiveness of syphilitic people to this type of infection.* As we know, the percentage of people have syphilis is rather high, and that it is particularly concentrated among the colored people, which may somewhat kill our arguments for those friends.

CHAIRMAN STERLING: One defense of the blondes.

MR. HARTSHORN: Do you recommend individual ventilation for cyanide plating?

MR. CARLSON: I am not an authority on this, I simply recited what was prepared for me. I would like to have someone in the audience answer that question. The question is, do you believe in individual exhaust systems for each tank? Is that right? Will somebody in the audience answer that question? We might have a little discussion on that, it might be a good point.

CHAIRMAN STERLING: What is the opinion?

MR. CARLSON: I imagine that chromium tanks and any other tanks where they are highly concentrated would have to be individually ventilated. I would like to hear some discussion from the floor on this question.

MR. HUESSNER: Mr. Chairman, I think the question relates directly to cadmium and I think it is the general belief that cadmium is extremely toxic. I think that Mr. Soderberg can probably tell us how toxic cadmium really is. If it is as toxic as reported probably you need ventilation on all cadmium tanks as a safeguard.

MR. SODERBERG: On that subject the question comes up rather frequently. I have this general impression that cadmium solutions are not the cause of trouble in the industry. What is causing trouble occasionally are the fumes of cadmium or cadmium oxide. When people remelt cadmium scrap without proper ventilation, they are very liable to run into cadmium poisoning.

The first point is the efficiency of the bath. The higher the efficiency, the less spray you have. The second is the surface tension of that bath. If you have organic substances which give you fine bubbles and the tendency to blanket formation, you will have very little material getting into the air there. I believe it is well to add some of these new wetting agents, even soaps, to tanks with rather low efficiency and where there is quite a little gas evolution.

Coming back to the cadmium. There are many different types of cadmium poisoning directly from the solutions. Naturally, there are difficulties, the solutions being alkaline, with skin rashes and things of that sort where people do not wash and keep clean.

MR. SCHREUR: We had a case in our plant where an inspector inspecting cadmium objects, got quite a rash, and I have been asked whether it was due to cyanide left on the objects, improper rinsing, or to the cadmium itself. Now, we have not had any such cases with men working the tanks, but this case was that of a woman inspecting the work. I would like to know if that is due to the cadmium or to the cyanide.

Incidentally, the woman's nickname is Goldie.

DELEGATE WALTER MEYER: I think the Cleveland Branch should be congratulated on presenting this paper to the American Electro-Platers' Society because it is of such vital interest. I am rather sorry that some of the points that were brought into the discussion passed so quickly and were not fully answered. First of all, in regard to pneumoconiosis.

Pneumoconiosis is the word Mr. Carlson was trying to recall. It is a generic term for those types of lung diseases. It is the very fine particles that cause the trouble, because the large particles do not get in through the very fine tissues where the lungs anastomose, or split up into the very fine tubes. Of course, silicosis can be contracted by breathing in large quantities of felt or hair. In the breakdown of some products a deposit of silica is left and considerable quantities of silica can be absorbed in that way. Now, in regard to this last question, I think there is a rather interesting test that should be brought to your attention in the study of dermatitis. There is a spot test, if you believe a person has an allergic tendency to some chemical. The usual procedure is to form a little pad or take a little bit of material and put it on one of the tender portions of the body, for instance, under the arm, for twenty-four hours, and if the person is hypersensitive to that chemical he will be broken out very strongly in that portion of the body where he was exposed to that particular chemical. In the case of the last question I believe they could have rather easily answered that by a spot test, first of all, by taking two pieces, washing one very thoroughly to make sure they removed the cyanide that may have been left on it, and, secondly, to put just clean cadmium against the skin.

The toxicity of solvents should be studied and brought to the attention of the Electro-Platers' Society more than it has. The cyclic compounds are particularly dangerous. It is not always the toxic effects of the compound in itself which should be considered, but in many cases it is the products of metabolism of the compounds in the body that should be considered.

Do not be fooled by the sweet smell of many solvents in the lacquer industry, because in the metabolism in the body some of these compounds break up into harmful compounds and cause

cirrhosis of the liver and hence, particular harm is done to the liver from those types of compounds. The particular harm in solvents such as carbontetrachloride, benzene or toluol (benzene is the worst) is due in a great measure to destruction of red corpuscles. In this regard, women are much more susceptible to poison from organic solvents than men. In general, I think we can say that women are much more susceptible to any type of poisoning in the plating industry or chemical industry than men, and we should watch the health of women operators very carefully.

Another factor is that we should not always wait for definite pathological symptoms to show up in a person, because that is like locking the barn after the horse is stolen. What we should do is to make more careful and periodic examinations of the workers. I have in mind lead poisoning and mercury poisoning, and one of the best methods of examination, and it is now being done, is to make a spectographic analysis of the urine. The amounts of lead, mercury and some of the other heavy metals can be obtained to gauge the progress of the absorption of these metals into the system.

CHAIRMAN STERLING: Has anyone else anything to add?

MR. HUESSNER: In regard to this question that came up in regard to cadmium rash, I know of one plant which plates a good many small items, such as tacks. These were put in the mouth, and they used to have "inspection rash" in that plant, but they found that the use of minute quantities of nitric acid in the rinse would eliminate it. I think, in general, there are very, very few people sensitive or super-sensitive to cadmium, because if you will go through the industry you will find thousands of operators carrying cadmium-plated tacks and cadmium-plated studs in their mouths every day, and if there was very much sensitiveness to it, they would not be able to do that. In fact, some people claim that it is almost as safe as some of the precious metals.

CHAIRMAN STERLING: Does anyone else care to discuss this paper?

MR. SODERBERG: I would like to expand on that just a little. The radio industry has a big assembly on cadmium. You can see hundreds and hundreds of girls sitting at long tables assembling cadmium-plated parts. Cadmium is not a problem in that industry on the assembly line. I believe in this particular case that was mentioned it was an individual sensitiveness.

CHAIRMAN STERLING: If there is no further discussion on the paper, I want to thank Mr. Carlson for presenting this paper. Let us give him a hand. (Applause)

I should also like to thank Mr. Meyer for his discussion.

Mr. Wittig of Milwaukee Branch makes a complaint as chairman of the exhibits committee that should be heeded at all future conventions.

Milwaukee, July 12, 1937

W. J. Kennedy, Secy,

Dear Bill:

I am writing a few lines in regard to an incident at the last convention that I wanted to pass up but think it should be known.

On the third day of the convention Mr. Walter Meyer, G. E. told me that the formula with his exhibit was gone. I had checked up all the exhibits and knew it was there. I told Mr. Meyer I had seen it, but did not know anything was missing, I then went to the Milwaukee Branch exhibits of which there were two and found that the formulae and process for doing the job also was gone. Who would do anything like taking the process from an exhibit? I am sure it was not a member but some one that wanted the process and thought it easier to take it instead of making a copy.

All members know that the process for doing a job must be with the job in order to compete for the prize. We hope that this will not happen again.

With best wishes I remain,

Yours truly

DAN WITTIG

Member of Prize Award Com.

We hope a closer watch will be kept on all exhibits and the formulae connected with them at future conventions. It is necessary to protect not only the good name of the A. E. S., but also our exhibitors who spend time and money in making these displays possible at our annual meetings. W. K.

MR. R. S. LEATHER'S DISPLAY OF GROUP PHOTOS AT THE NEW YORK CONVENTION

At the recent convention one of the things that created most favorable comment on all sides was the display of group photos of previous A.E.S. conventions. Some of these were loaned to Mr. Leather and have a good deal of value attached to them by the owners because of their age and sentiment. One such picture of the Chicago Convention in 1914 was missing when they were being packed for return shipping. This picture was the private property of one of our most respected members, Past President A. L. Gilbertson of Chicago. It is entirely possible that it has been mislaid in packing; if anyone has this picture in his possession, kindly return it to Mr. R. S. Leather, the Lea Mfg. Company, Waterbury, Conn., who spent many hours of labor and spared no expense in getting this fine display of photographs together for the enjoyment of the A.E.S. members and friends who attended the convention.

The Electroplating Circuit

Presented by

J. H. HOEFER

To the Anderson Branch
of The American Electro-Platers' Society

DIFFICULTIES in the operation of any electroplating unit take their origin from many sources. In instances more frequent than many of us appreciate these difficulties are traceable to faulty conditions in the electroplating circuit. In spite of the importance of the electrical phase of electroplating we are prone to neglect it and devote most of our study to the chemical and metallurgical aspects of plating.

It is true during the past decade chemical and metallurgical research has yielded some remarkable improvements in the art of electrodeposition. We need only mention the development of chromium plating, high current density nickel plating and bright deposits of the various metals to remind ourselves that chemical research has immensely widened the scope of electroplating. The electroplater owes a lot to the chemist and the metallurgist for the excellent work they are performing in the field of electrodeposition.

My personal opinion is that the time is now ripe to extend an invitation to the electro-physicist and the electrical engineer to exert their specialized abilities in the improvement of electroplating.

The chemist and the metallurgist each look at a specific plating problem through colored glasses characteristic of their particular training. The electro-physicist views the same problem through spectacles of a distinctly different hue. We all know how the same picture appears differently when viewed through different colored glasses; how new beauty is revealed.

Many different viewpoints are also extremely helpful when viewing the composite electroplating picture in order to give it new beauty and usefulness.

The electroplater is very much like the old country doctor. For most plating ailments he knows the remedy. Now and then he has to call in a specialist. And like the country doctor he

has to know when not to call in the specialist but to merely administer the old reliable "castor oil and quinine".

To the chemist a plating problem is a matter of securing the proper proportions of chemicals. He will analyze the plating solution and report the additions required to bring the various chemicals back to their proper proportions. He will show you charts and tables which prove what concentration of a certain chemical is best.

To the metallurgist a plating problem is a matter of the proper treatment of the base metal. If it has been cold worked or due to other conditions it does not have the proper crystal structure faulty plating is bound to result. He will show you micro-photographs and etched specimens to prove his point.

Both the chemist and the metallurgist are quite helpful to the electroplater but here is one thing the electroplater must remember and that is that both the chemist and the metallurgist, by the very nature of their specialized training unconsciously wear colored glasses. They like the surgeon may recommend a major operation for a head ache when you, as the family physician know that only an aspirin is required.

This somewhat lengthy introduction is given so as to obtain a true perspective of the development of electroplating. Michael Faraday, the father of electroplating was an electro-physicist. The electro-physicist is interested not only in what takes place between the anode and the cathode but also in every physical and electrical phenomena taking place throughout the entire electroplating circuit.

Now then let's put on the spectacles of the electro-physicist and make a survey of the electroplating circuit.

Faraday's law of electrodeposition is a specific application of that more comprehensive law — the law of the conservation of matter and energy. Faraday discovered the fundamental principle of electroplating that for the transfer of a specific quantity of electrical energy a definite equivalent quantity of material is transferred from the anode to the cathode. If the anode solution and cathode deposition are 100% efficient there is no loss of energy except that due to resistance of the electrolyte.

This phenomenon as occurring in the zinc sulfate plating bath may be expressed as follows:

$$\text{At anode } \underset{\text{metal}}{\text{Zn}} \text{ plus } \overset{--}{SO_4} = Zn\,SO_4 \text{ plus } 248{,}000 \text{ cal.}$$

$$\text{At cathode } Zn\,SO_4 = \underset{\text{metal}}{Zn} \text{ plus } SO_4 - 248{,}000 \text{ cal.}$$

At the anode the amount of metal brought into solution by a given quantity of current is always the same. The amount of energy liberated at the anode and the amount of energy absorbed at the cathode are identical. Energy is not always liberated at the anode and absorbed at the cathode. In the case of the copper plating bath we have the following reactions:

$$\text{At anode } \underset{\text{metal}}{\text{Cu}} \text{ plus } \overset{--}{SO_4} = Cu\,SO_4 - 142{,}000 \text{ cal.}$$

$$\text{At cathode } CuSO_4 = \underset{\text{metal}}{Cu} \text{ plus } SO_4 \text{ -- plus } 142{,}000 \text{ cal.}$$

Here again there has been no net change in the total energy of the system. However, in the case of copper, energy is absorbed at the anode and liberated at the cathode which is the reverse of the action of zinc.

This is in harmony with the negative sign of the single electrode potential of zinc, which is - 0.76 volt and the single electrode potential of copper which is plus 0.34 volt. These single electrode potentials lose considerable of their importance from the standpoint of the total energy in the plating system when the metal taken from the anode is equal to the metal deposited at the cathode. However, in the case of a chromium plating bath single electrode potentials are important. The single electrode potential required to discharge oxygen at the anode is plus 0.40 volt. The single electrode potential of chromium deposited at the cathode is - 0.70. Added to these voltages we must add the hydrogen over-voltage at the cathode and the oxygen over-voltage at the anode. These combined over-voltages account for approximately 2 volts depending on the velocity of the electrode processes. The resistance of the electrolyte in the ordinary chromium plating tank accounts for 1 volt drop. The loss in voltage then totals 4.1 volts. This means that in an ordinary chromium plating system a voltage much below this figure will not do chromium plating satisfactorily. It also means

that no matter how close the anode and cathode less than 3.1 volts will not produce chromium plate.

Of course these voltage figures are not inflexible and will vary with load conditions, anode current densities and cathode current densities.

In order to show the voltage curve under various conditions of load on a chromium unit it is necessary only to take tank and line voltage readings after progressive unit changes of load. Such readings were taken on a large chromium plating tank. Cathodes were placed in the tank increasing the load in uniform steps until a total load of 5000 amperes was obtained. The cathode current density was maintained at 140 amperes per sq. ft. throughout the test. The generator voltage was maintained at 7 volts. Due to the fact that the generator was a 15,000 ampere machine and supplied current to three chromium plating tanks, each requiring 5000 amperes under full load, tank rheostats of 5000 ampere capacity were used.

Rheostat Switch No.	*Current Density*	*Voltage At Generator*	*Amperes*	*Tank Voltage*	*Rheostat Voltage*	*Line Voltage Drop*
1	142	7.0	100	3.8	3.2	0.0
2	141	7.0	200	4.1	2.9	0.0
3	140	7.0	400	4.4	2.6	0.0
4	140	7.0	800	5.0	2.0	0.0
5	140	7.0	1200	5.2	1.8	0.0
6	140	7.0	2000	5.8	1.1	0.1
7	139	7.0	2700	6.1	0.7	0.2
8	139	7.0	3900	6.3	0.35	0.35
9	138	7.0	4950	6.4	0.1	0.5

The accompanying chart shows how the tank voltage has to be increased to maintain a constant cathode current density. In going from no load to full load in this tank it is evident that the single electrode potential of hexavalent chromium has not changed nor has the hydrogen over-voltage because both are a function of the cathode current density which has not changed. The anode current density, the oxygen over-voltage and perhaps the oxygen single electrode discharge potential have changed. These changes together with the increase in the voltage drop of the electrolyte and the very slight increase in the voltage drop of lead anodes account for the total increase in tank voltage.

There were several interesting features about this test. First was the graduated voltage drop of the rheostat. The general run of tank rheostats have a constant 3 volt drop. The principal

characteristic of the 3 volt drop rheostat is too much current at small loads and not enough current at larger loads. We are all familiar with the futility of trying to secure the name plate amperage from the last two switches of the ordinary rheostat when all of them up to that point have been thrown into the circuit.

A survey of the voltage drop in other plating systems will reveal the same tendency as chromium though not as pronounced. Chromium plating is the most inefficient plating process known. Under ideal conditions the efficiency is not more than 16%. Since the law of Conservation of Energy states that energy cannot be created or destroyed the energy not used in plating must appear as side reactions or maybe it would be more consistent to state that the chromium plating bath is a hydrogen plating bath with chromium plating as a side reaction accounting for 16% of the energy transferred.

Fortunately other plating systems are more efficient than chromium but they too have their particular electrical characteristics. The cyanide plating baths polarize quite readily at the anode forming insulating films which in some cases completely prevent the transfer of electrical energy.

This phenomenon was demonstrated quite forcibly to me about a year ago. We were operating a small brass plating barrel, when the voltage was maintained at seven volts the total current indicated by the ammeter was 60 amperes, equivalent to an anode current density of 40 amperes per sq. ft. We decided we wanted to increase the rate of deposition. The voltage was boosted to 12 volts; the amperage jumped to 70 amperes but immediately started to decrease falling below 20 amperes and would have gone to zero even under the increased voltage pressure. If a certain critical polarization voltage is exceeded polarization will take place and current will cease to flow. Polarization is that phenomenon which results when the products of electrolysis either at the anode or cathode accumulate faster than the current can carry them away. Saying that the anode is polarized is just a high sounding way of saying high current density has "clogged up the works". The electro-physicist explains the foregoing phenomenon by stating the value of oxygen over-voltage plus the oxygen discharge voltage was higher than

the polarization voltage, in which case electrically speaking it was easier for the anode to polarize than it was for the oxygen to be discharged at the anode. In the case of the lead anode in the chromium solution if an insulating polarization voltage exists it is quite high and therefore oxygen discharges readily.

Polarization is not always carried to the point where insulation takes place but still the polarizing action is evident because of the reduced concentration of the electrolyte around the cathode and the increased concentration of the electrolyte around the anode. It requires a definite voltage to overcome this action in a plating bath and the net result of this concentration polarization is to increase the voltage required for electrodeposition. In addition to the voltage losses at the anode and cathode and the resistance of the electrolyte there are also voltage losses due to the resistance of the anode, the cathode, the rheostat and the busbar. If the busbar is of copper it will have a specific resistance of .00000173 ohms per cubic centimeter. Stated in another way copper has a resistivity of 1.73×10^{-6} ohms per cubic centimeter. After cutting off all the nomenclature to the right of the number 1.73 we can make a table of comparative resistances of metals and electrolytes:

Copper	1.73	
Aluminum	2.83	
Tin	3.4	
Brass	6.0-9.0	
Nickel	7.8-11.8	
Cadmium	8.65	
Iron	10.0-15.0	
Lead	22.0	
Copper sulfate Plating Solution		5,300,000
Zinc sulfate " "		24,500,000
Chromium " "		2,360,000

This table is given so that comparative magnitude of the total resistance factors become evident. The voltage drop due to the resistance of the plating solution is not as tremendously greater than the voltage drop due to the bus bar and the anode because the copper bus car carries one thousand amperes per sq. in. while in a chromium electrolyte no part of the solution has to carry much over 1 ampere per sq. in. But even with the greater current density in the copper, the current density in the solution is a much greater factor in figuring voltage losses. This

table means what if a copper conductor has a voltage drop of .1 volt in 100 ft. the chromium solution has a voltage drop of 1.36 volts if the distance from anode to cathode is one foot. This voltage drop is due to the resistance of the solution and must be added to the polarization voltage, the single electro discharge voltage and the electrode over-voltages.

When considering voltage losses in the plating bath itself the chromium plating bath must be given the greatest prominence because quite a number of other baths show voltage losses due only to resistance of the electrolyte and concentration polarization. They do not react to produce hydrogen and oxygen discharge voltages nor do they exert an over-voltage due to continuous gas discharge. The notable example of this type of bath are the copper sulfate and nickel sulfate baths. With low acid contents these baths have practically 100% anode and cathode efficiency. Of the cyanide type the cadmium, silver and gold plating baths are very efficient both at the anode and cathode. Zinc and copper cyanide plating solutions show a high anode efficiency and a 50 to 80% cathode efficiency.

It is sometimes helpful to use iron anodes in these solutions in order to keep the metal content from building up too high. In this case we are purposely decreasing the efficiency of the anode in order to secure a better balance with the cathode efficiency. This procedure necessarily discharges oxygen on the insoluble iron anode.

If anode efficiency is not 100% some side reaction such as the discharge of oxygen has to take place. The law of the conservation of energy like the law of gravity cannot be broken. All of the voltage losses or so-called inefficiencies must be accounted for, either through dissipation as heat or the formation of new substances containing more energy than the original substance. The electro-physicist can help to improve the efficiency of the remainder of the electroplating circuit. We have mentioned the inefficiency of a chromium plating bath, but a modern chromium plating unit has an over all efficiency which is comparable to a cyanide copper plating unit if a tank rheostat is used with the copper and the chromium plating tank

is connected directly to the generator. In the copper unit at least half the power is lost in the tank rheostat.

The separately excited generator directly connected to the plating tank and driven by a synchronous motor represents the highest development in the matter of current production for the electroplating circuit. Without manufacturing cases I know of a plant where a 2000 ampere 6 volt self excited generator is driven by an induction motor, supplying current at 6 volts to a semi-automatic nickel plating tank, the maximum voltage required is 4 volts. One third of the power produced is dissipated in the tank rheostat. This power loss over a period of 300 days of 8 hours each with power at $0.04 per kilowatt hr. would amount to $648.00 annually.

There is nothing in electrical engineering practice that prohibits the design of a 2000 ampere 4 volt generator separately excited and driven by a 15 H.P. synchronous motor.

Such a current producing unit would not only save the power ordinarily dissipated in the rheostat but due to greater motor efficiency and power factor improvement a further annual saving of upwards of $150.00 could be made. The tank rheostat has just about outlived its usefulness. If it has any future at all, it will be of the graduated voltage drop type.

The suggested improvements in power application made in this discussion are of a necessity of a general nature. Individual requirements will differ and any changes in electrical equipment must take into account these individual requirements.

We have completed our little survey of the electroplating circuit without much comment on improving the speed of electrodeposition. Great strides in that direction are being made and still greater improvement will be seen, but the most obvious step to take for the present is the reduction of power loss in the electroplating circuit. In the past power costs have been overshadowed by labor costs but with the advent of automatic plating equipment power costs are becoming more and more a major factor in the total cost of electroplating.

What are we going to do about power costs? Let us make the power released in the electroplating do a full time job.

Solution Efficiency

By AUSTIN FLETCHER

Foreman Plater, Brewer Titchener Corp.
Binghamton, N. Y.

Read at Regular Meeting of the Binghamton-Elmira Branch

SOLUTION EFFICIENCY is without doubt the most important subject to the plater today.

Our good friend, George Hogaboom in his paper on Zinc Plating finishes up by saying "The plater must know the efficiency of the solutions used if he depends upon the reading of the ammeters and time consumed when plating to meet specifications."

How many of us are able to go up to a tank and say "Now this solution is 80% or 90% efficient, therefore, I will have to put through an additional 20% or 10% more amperes." I am afraid not many.

After working on Solution Efficiency for four years there are today many tanks in our plating room which are still a puzzle.

I must tell you what happened after the Bridgeport Convention where I made a brave attempt to report some of the results obtained in a barrel while cadmium plating. A gentleman I had never met before and who did not recognize me, was visiting our plant. He had been to the Convention and the talk finally came around to the practical papers on the program. When I asked him what he thought about the paper on Barrel Cadmium he said "We all know that fellow is crazy." Perhaps you will think the same after I have finished.

I would like to show you the results of Solution Efficiency tests made in plating barrels under ordinary production conditions on Cadmium, Zinc, Copper, and Nickel.

We will start with the cadmium tests with which some of you are familiar.

Cadmium

Solution 1½ to 2 oz. cd.
9 oz. free cn.

42" Bal. 5 yrs. old — Av. of 86.8% Efficient.
24" " " " " " 97.6% "
42" Bbl. new " " 100% "
24" " " " " 98% "

Later tests finally showed 100% on the 24" Bbl.

In the above note especially in the solution of 3.5 Ni the results obtained with the different pH, also the 6.5 Ni with the

It has been the general belief that when a barrel has been in service for several months the efficiency would be somewhere around 50 or 60%. The above tests show that after 5 years the barrels were still holding their own and far above 50 or 60%.

The above averages are the results of approximately 40 test runs.

Zinc

Solution Zn Cn 9.72 oz.
Total Cn 12.8 oz.
Total Alk 13.1 oz.
1. Temp. 86 amp. 375 sq. ft. 52 Efficient 99.2%.
2. " 86 " 375 " " 52 " 99.2%.
3. " 86 " 375 " " 26 " 86.8%.
Solution Zn Cn 8.4
T Cn 13
T Alk 12
1. Temp. 86, amp. 440, sq.ft. 92, Efficient 84.6%.

In the solution with 9.72 oz Zn Cn it will be noted that tests run with a 52 sq. ft. load are much better than the one of 26 sq. ft. In fact, the same rule seems to hold true in practically all solutions. Best results are secured with a maximum load, but overloading will give an uneven distribution of plate.

The solution with 8.4 oz. Zn Cn and the higher cyanide with 92 sq. ft. only gives us 84.6%.

Nickel Barrel No. 2

Solution		*Temp.*	*Amp.*	*% Efficient*
Ni 7.2 oz. Ch 5.8 oz. pH 5 Boric 3 oz. Ammo & Sod. Sul. 3 oz.	1	70-90	144	91
	2	90	156	108
	3	90	160	113

		Runs	*Temp.*	*Av.Amp.*	*Av. % Efficient*
Ni 6.5 oz. Ch. 5 oz. pH 5.8 Ammo Sod. Sul. 3 oz. Boric 3 oz.	1	1	86	144	90
	2	4	88	144-148	96
	3	1	90	146	98

		Temp.	*Av.Amp.*	*Av. % Efficient*
Solution same as above only pH 5.6	1	79	159	53.4
	2	89	168	63.2
	3	86	173	54

					pH
Ni 3.5 oz. Ch 2.4 oz. Boric 1¼ oz. Ammo Sod. sul. 1¼ oz.	1	92	122	87.2	5
	2	90	150	57	5.6

pH of 5.6 — for some reason pH 5.6 seems to be a good thing to stay away from in a barrel.

With the first solution 7.2 oz. Ni, the ammeter would not steady down so as to secure a fair average.

The solution of 6.5 Ni and pH 5.8 would give good results and would be the same over a period of years.

Note also the better results obtained with a slightly higher temperature with all the solutions.

Nickel Barrel No. 3

Ni 6.4 oz. Ch 5.5 oz. pH 5.8 Boric 3 oz. Ammo & Sod. sul. 3 oz.	Temp. 86, amp. 149-165 8 runs, 84 to 92%, Average 88.8% 20 sq.ft. to load.
Ni 4 oz. Ch 2.8 oz. pH 5.8 Boric 1¾ oz. Ammn & Sod sul. 1¾ oz.	Temp. 86, Amp. 90-105 2 Runs, 75 to 77%, Average 76 16 sq.ft. to load.

In the above Bbl. No. 3 the production job was such that the sq. ft. surface had to be small which accounts for the wide fluctuating of the ammeter and the low efficiency.

Copper

Sol.		*Temp.*	*Amp.*	%	*Load*
No. 1	Copper .7 oz. Free Cn. .8 oz.	110	116	24	Single
No. 2	Copper 1.45 oz. Free Cn. 1.24 oz.	94	140	32.6	Single
No. 3	Copper 2 oz. Free Cn. 1.5 oz.	1 100	165	27.6	Single
		2 98	145	28.6	"
		3 96	122½	29.3	"
		4 90	140	29.9	"
No. 4	Copper 2 oz. Free Cn 1.5 oz.	1 80-86	195	40	Double
		2 100	215	30	"
		3 100	215	29.2	"
No. 5	Copper 2.3 oz. Free Cn 1.3 oz.	1 85-100	165	14.5	1st load Monday A.M.
		2 110	165	26.5	Single
		3 110	165	27.1	Single
No. 6	Copper 2.77 oz. Free Cn 2.4 oz.	1 92	185	21	Single
		2 93	185	17	"
No. 7	Copper 4 oz. Free Cn 2.8 oz.	1 92	165	45.5	Single
		2 94	175	36	"

The results on copper show that a heavier load will give the best results. Also that temperature plays an important part.

It is very interesting comparing these temperatures.

Sol.	*Temp.*	*% Efficient*
No. 3	100	27.6
	98	28.6
	96	29.3
	90	29.9

Note how the efficiency increases.

Sol.
No. 4 80-86 Temp., 40%
100 Temp., 29-30%

No. 7, 92 Temp., 45.5%
94 Temp., 36%

Should any of you gentlemen be interested in determining the efficiency of your solutions the following method will be found quite simple.

Clean and weigh a load of work.

Set the ammeter at a certain amperage.

Plate for 1 to 2 hours.

Dry work and reweigh; find number of ozs. of metal deposited. Let us say it is 5 oz.

Also assume we had 150 amp for 1 hour.

Now take the actual amount of metal deposited and divide that by what should be deposited at 100% efficiency.

Ex:
Cu will deposit per amp hour at 100% .0836 oz x 150 = 12.54 oz.
Ni " " " " " " " .0385 oz x 150 = 5.78
Cd " " " " " " " .074 oz x 150 = 11.1
Zn " " " " " " " .043 oz x 150 = 6.45
12.54(5)40% cu 5.78(5)86% ni.

Now gentlemen, admitting that these tests are for from 100% correct, but hoping they may be of some value to some one or may help to create interest for further investigation, I thank you.

Business and Social News

BRANCH NEWS

Educational Activities

AMERICAN ELECTRO-PLATERS' SOCIETY

BRIDGEPORT BRANCH

The July meeting and Old Timers night was held July 9 at the Contract Plating Co., 540 Longbrook Ave., Stratford, Conn. Joe Sterling, president, presided. Regardless of the heat there were 35 members present, the New Haven Branch being well represented.

The roll of officers was read and all present but the vice-president, William Ehrencrona who is on a vacation. The minutes of the last meeting were read and accepted.

Committees:

The sick committee would like the members to please notify the following committee when they hear of any member or wife ill.

Herman Brown, Stamford; Eugene Phillips, Bridgeport; Wm. Flaherty, Bridgeport.

No applications for membership.

The report regarding our finances and membership was read for the fiscal year ending May 31, 1937. A motion was made to place it on file.

Unfinished Business:

The Outing Committee, Joe Sterling, George Wagstaff, and Herman Braun with cooperation of the New Haven Branch are planning for the outing to be held sometime in September. The Secretary will notify the members when this is to be held.

Report from Convention Delegate:

Mr. Walter Meyer gave a very interesting talk on the different papers that were read; he also gave a good report on the convention. Bridgeport was very sorry in losing the cup as Bridgeport had as fine exhibit as shown. Keep your eye on Bridgeport at the next Convention.

New Business:

Motion made and passed to eliminate the August meeting.

The membership committee, Eugene Phillip, Joe Sterling, and Dave Willard will have several new members when the meetings start in September.

Mr. Walter Meyer gave a very interesting talk on the Chemistry Class that will open in the fall. This class will begin on General Plating. It will consist of 20 lessons, all members joining it. With the help of some members who are chemists Walter will have no trouble in making it a success.

Mr. Meyer gave an outline of the Educational Sessions to be held and he hoped all members would be interested. He introduced Mr. John Charleson of Yale and Towne as the guest speaker of the evening. He spoke at length on Copper, Brass and Nickel Plating of Die Casting, showing samples of the work he has done and the copper plating in Rochelle Salts Solution which is a very fine finish. Mr. Charleson gave the method in cleaning and pickling and plating of die castings. Mr. Charleson gave the formula of copper solution used which gave very good results:

5 oz. Metallic Copper
5 oz. Rochelle Salts
1½ oz. Free Cyanide

The nickel solution used is the following:

25 oz. Single Nickel Salts
5 oz. Nickel Chloride
3 oz. Boric Acid
P. H. 6

This is the hot solution 115° F., 100 amp. per square foot.

A rising vote of thanks was given to Ray O'Connor who made it possible to hold the meeting in a nice cool spot. Also Mr. Charleson for the very interesting talk on Die Casting. The meeting then adjourned to let the members and guests partake of refreshments which were plenty. The committee, Ray O'Connor, Walter Meyer, and F. Lancaster did not forget it was a hot night and provided cold beer for the hot boys. It was early in the morning before the party broke up, all having a good time.

WM. H. FLAHERTY, *Sec.-Treas.*

MILWAUKEE BRANCH

The Milwaukee Branch held its monthly meeting July 8, 1937, and though it was a very hot night, a large group of members and guests were present to hear the interesting report of the National Convention. Mr. Ray Goodsell, our president, gave a complete resumé of the papers, side trips, and business meeting, and from his talk, a lot more of the Milwaukee Branch should have attended the New York meeting.

It is of great interest to our branch that we are going to be hosts to the Annual Convention next year, and, we believe, that the slogan should be "On to Milwaukee in '38, as the Convention is going to be great."

R. M. Goodsell is chairman of the Research Committee in this branch, and he reports excellent progress with many of the firms in his home town of Racine. He is also getting several new members in doing this well-worthwhile work.

At this meeting we decided not to have a meeting in August, but to get off to a great start in the September meeting, and have a well organized educational session during the winter months.

The last business of the evening was the selection of a committee to get plans started for the Convention of next year. Ray Goodsell, being a member of the National Board, was chosen as Chairman, well known Robert Steuernagel as Treasurer, and A. J. Hermansen as Secretary. We hope to start early and make this a real platers' affair.

Walter B. Atkinson was elected as an active member and Henry C. Stewart elected an associate to our Branch. Mr. Morton C. Frost, associate, and Mr. Louis O. Jorgensen, active, both of the Frost Co., of Kenosha, Wis., made application for membership.

A. J. HERMANSEN, *Sec.-Treas.*

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch was held July 10, 1937, at the Atlantic Hotel.

President E. Stepka presided and all other officers were present.

The following applications were read and committees appointed on same: E. W. VanGoethem, T. J. Walther, H. W. Conn.

The following members were elected to active membership: O. Henninger, A. J. Lemrise, J. Cerceo, L. Keiser. Mr. O. Kocour was elected to associate membership.

Mr. F. J. Hanlon made a very interesting and complete report on the

New York Convention and several other members spoke about the interesting things that they saw while in N. Y.

Mr. O. E. Servis, the Librarian, found the following questions in the question box:

No. 1. *What effect will an excess of ammonia chloride have in a brass solution?*

Ans. Changes the color of the deposit, and builds up chloride; it is not advisable to have an excess.

No. 2. *Steel articles plated with nickel when put in a* 20% *salt solution stand* 3 *hrs. test. How long will these articles last in ordinary use,* 1, 2, *or* 3 *years?*

Ans. It depends on just what use they are put to, inside or out. It was stated that these were used in the house so in that case they would stand up for at least one year or more.

No. 3. *What is a good etch for steel cadmium plated for microscopic test?*

Ans. Alcohol solution of ammonium nitrate.

J. W. HANLON, *Secy.*

NEWARK BRANCH

The monthly meeting of the Newark Branch, A.E.S., was held on Friday evening, July 16, 1937, at the Krueger Club, Belmont and Springfield Aves., Newark, N. J.

As our president was absent, the meeting was opened at 9 p.m. with Mr. William Hodecker, Sr. Vice-president, occupying the chair. The following officers were present: William Hodecker, Vice-president; George Wagner, Secretary; Paul Oldam, Librarian; and Roy Stout, Sargeant-at-arms.

The minutes of the previous meeting were read and approved.

Mr. Wagner, Chairman of the Fishing Committee, reported that all arrangements had been made for our Annual Fishing Trip to Waretown, N. J., date August 14th, cars to leave the Essex house, Broad Street, Newark, N. J., at 5 p.m. on August 13th. He urged all the members who wished to attend to return their cards for reservations no later than August 2nd.

Mr. Horace Smith was elected General Chairman of the 1939 Convention to be held at Asbury Park, N. J., and at the same time he was given the right to appoint all committees for the event. Mr. Smith

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gave a very good talk on the way he proposed to arrange for a successful International Convention. With approximately two years to go, he stated that it would mean work from now on until after the convention.

Mr. Austin Fletcher, President of the Binghamton-Elmira Branch, was present and he was called upon for some remarks which he was glad to make. He said he was grateful to Newark Branch for being nominated and elected as Third Vice-president of the Supreme Society.

Mr. Paul Oldam, our Librarian, announced that he had about 22 speakers for the coming Fiscal Year and asked for permission to have programs printed consisting of: the names of the speakers; the meetings at which they will speak; conversion table of weights and measures; atomic weights; metal contents and plating salts; and other valuable information to the platers. He also asked permission to solicit ads from Manufacturers to help defray the expenses concurred in the printing of this program. Upon motion duly made and seconded it was voted that Mr. Oldam be granted his request and he was appointed Chairman of the Program Committee.

After some discussion it was decided that Newark Branch should have a Chemistry Class for the coming winter months and Mr. George Reuter was appointed Instructor for this Class.

28 members attended this meeting which adjourned at 11:30 p.m.

GEORGE WAGNER, *Sec.*

WATERBURY BRANCH

The July meeting of Waterbury Branch was held in Engineers Hall, Friday evening, the 9th. The attendance was rather slim, and only routine business was transacted.

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Favorable action having been taken on the application of Patrick Vitello, of the Lux Clock Co., for associate membership, he was declared elected.

The proceedings of the recent convention in New York City furnished the principal topic for discussion. Commencing in September, meetings of the local Branch will be held in the Hotel Elton, and arrangements for same will probably be taken up at the August meeting.

WM. F. GUILFOILE, *Sec.*

PHILADELPHIA BRANCH

Board of Officers held a meeting at Fred. Fulforth's Home. Meeting called to order by Pres. Joe. E. Underwood. Roll call—officers all present. The Reading Meeting Committee reported that Mr. J. L. Nelson is to arrange for transportation and entertainment; Vice Pres. Fred. Fulforth for the securing of the speaker; Mr. G. Gehling to inquire for the hall and report at the next meeting; so as to have proper time to notify the members through the Quaker City Reminder; the October Meeting to be held in Harrison Lab. U. P. in

conjunction with the Research Committee. A. Hirsch has charge of this meeting. The banquet and yearly meeting is to be held in Nov. Mr. Nat. Verrelle chairman made the following appointments: Programme, Joe. E. Underwood and R. E. Jackson, Jr.—Tickets, G. Gehling—Door Prizes, Fred. Fulforth—Hall and Menu, R. E. Jackson, Jr. and H. Snyder. Permits, G. Gehling and H. Snyder—Educational Session, A. Hirsch. The hall committee to inquire at the several hotels as to the service and report at the next meeting. The object of the Upstate meeting is so that our out of town members can be more acquainted with their fellow members also for the advancement of the Society both in membership and fellowship.

The membership question was then taken up and the following were placed before the members present; moved and seconded that the following names be dropped for non-payment of dues, C. Debler; M. Dumsha; J. Dinan; J. M. Kreider; H. C. Simmons; and A. Fleming, carried. The resignation of Geo. H. Shappell was accepted. There being no further business, meeting adjourned until Aug. at the call of the Pres. Joe. E. Underwood.

ROBERT E. JACKSON, JR., *Sec.*

SAN FRANCISCO BRANCH

Mr. H. Heerings former Secretary of San Francisco Branch writes as follows: I believe our Branch is taking on new life with a number of new prospective members and better planned meetings. Mr. H. M. McKibben is acting as Secretary pro tem. until new officers are elected.

Mr. Heerings states in his letter that the members of the branch being so far away feel the loss of not being able to attend the annual conventions.

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We are glad to hear from Mr. Heerings, and hope it may soon be possible for some of their members to be with us at our yearly meetings.

BINGHAMTON-ELMIRA BRANCH

The Librarian of Binghamton Branch, George Simmons has completed arrangements for the first meeting of the year, which will be held, Friday, September 24 at the Y. M. C. A. in Binghamton. Dinner will be served at 6:30. The speaker will be Walter Meyer of General Electric Co., Bridgeport, Conn. Mr. Meyer will present "A Graphic Study of Plating." Many of our members who have seen this study are anxiously awaiting the opportunity to see it again.

For those who have not had the opportunity we will say, "If you want to see a plating solution projected on a screen with the current passing through it and to note the happenings at the anode and cathode when various constituents are added to a bath, don't miss the meeting at Binghamton, Sept. 24. You will never forget it."

AUSTIN FLETCHER, *Sec.*

MONTREAL BRANCH

Thunder, lightning and a deluge of rain failed to keep most of the members of the Montreal branch from attending the first meeting to be held under the chairmanship of our new president and in our new meeting place, the New Carlton Hotel. We also had with us several ex-members of the society and of new applicants whose presence delighted us and assured us that the Montreal branch is headed for better times.

Our little French-Canadian president, Mr. L. Lariviere addressed the meeting as follows: "Gentlemen, it is only fitting, that at this, the first meeting of the Montreal Branch of the American Electro-Platers' Society at which I have the honor of presiding, to express to you my deep appreciation of the honor you have done me in electing me to be president of this branch of the society.

"To the officers recently retired I wish to express my especial thanks for the work that they have done for so many years past in forming and keeping together this branch. They have steered the ship through many a stormy sea. I do hope that their advice will be available to me and to my fellow officers for many years to come.

"We have with us tonight quite a number of gentlemen connected with the electro-plating business in Montreal who are not at present members of our society. I trust that these gentlemen will tonight avail themselves of the opportunity of joining us. It may interest you to know that at the 25th. Annual Convention held last month in New York, and about which we will hear later in the evening, 810 people sat down to the banquet. Our membership now numbers 1500. 1500 platers and chemists cannot be wrong in wanting to get each month the 'MONTHLY REVIEW,' attendance at their branch meetings and the interchange of opinions with their fellow workers.

"To our older members I ask support and that quality of give and take that will help us all to make this branch a success in the society."

After hearing from one of the New York convention delegates, Mr. Chas. Douglas, the meeting was turned over to our genial friend and counselor, Mr. E. Creighton who read a paper on "Inclusions in electrodeposits" which received the rapt attention fully due his excellent work and which provoked a most interesting discussion.

It is quite a time now since you, Mr. Editor have received a report from the Montreal Branch and we are resolved that it will not be the last. Your visit here some time ago kindled the flame which we will keep burning.

J. T. CRONIN, *Sec.*

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The Abstract Section

R. H. GOODSELL, *Chairman, Program and Educational Committee*

Slimes in Electrolytic Baths by R. TICQUET, *Metal Cleaning and Finishing*, Vol. **9**, No. 6, page 507, June, 1937—Slimes and solid particles which are found in plating baths are injurious to the plate, and are caused by droppings from the anodes, drag-in by the work, and dust from the air. If the solution is worked so as to stir up these particles, these particles must be removed from the bath. This may be done by filtration by gravity, filtration under pressure, centrifugal separators, and filtration and centrifuging combined. Descriptions, and advantages and disadvantages of each of the above pieces of equipment and also the proper types of apparatus to use for the different solutions are stated.

The Electrolytic Theory of Inhibiting, *Metal Cleaning and Finishing*, Vol. **9**, No. 6, page 487, June, 1937—There are different kinds of scale and each are formed at different temperatures. In the removal of scales we may remove too much of the iron, and this may be prevented by the use of a group of compounds called inhibitors. Inhibiting is done by insulating substances having a high positive charge which can be attracted to negative particles that exist on the surface of the steel. No specific materials are given, but the compounds that may be used are in the bakelite family. The inhibitor prevents pitting by stopping the galvanic action between iron and iron carbide. A good inhibitor must have a high solubility, good strength, low cost stability in heat, great affinity for the steel, high dielectric strength, the ability to be rinsed off without staining.

An Electroplating Department for a Small Manufacturer, by ROBERT J. GREEN, *Metal Industry*, Vol. **35**, No. 7, page 344, July, 1937—The equipment necessary for the setting up of a plating department covering cleaning, burnishing, copper, bright nickel, and white nickel plating is described. The cleaning unit, procedure, concentration of cleaners and dips, special equipment, etc., is described in detail. Instructions are given for the mixing of the copper and nickel solution. The article will be concluded in a later issue.

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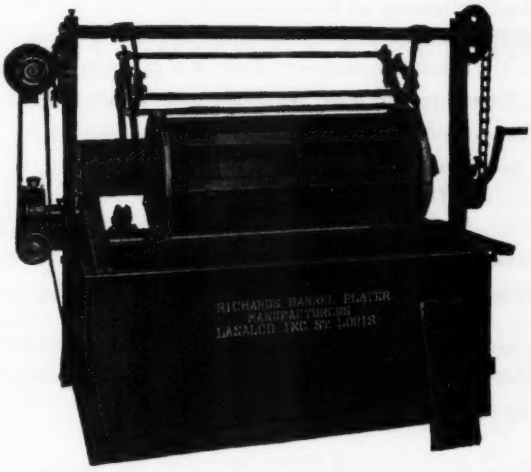

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Testing and Stripping of Electrodeposits by Dr. B. EGEBERG and N. E. PROMISEL, *Metal Cleaning and Finishing*, Vol. **9**, No. 6, Page 493, June, 1937—This is the concluding article of a series of three, and is a discussion of testing for adhesion to the base, hardness, wear resistance and porosity of nickel, cobalt and nickel-cobalt alloys. Adhesion is tested by bending or twisting the piece around a mandrel or giving the piece any other standard bend; deformation of the basis metal, and by actually pulling the deposit from the basis metal. Hardness is tested by a micro-Brinnell machine and a scratch-hardness tester; nickel deposits vary from 150 to over 500 Brinnell, and the hardness is governed by the type of plating bath used.

Wear resistance does not necessarily indicate hardness and must be measured. This is done by wearing the plate with a standard abrasive on a wheel, or by spraying the abrasive on the piece.

Porosity of the plate cannot be studied by the microscope, but may be determined after the surface is perfectly cleaned by the salt spray test, the ferroxyl test, the copper ammonium carbonate test (when the basis metal is brass or copper), the intermittent immersion tests, the humid atmosphere test, the hot water test, the salt peroxide immersion test, and the outdoor or service corrosion tests. Of these tests the ferroxyl test is most popular when the basis metal is ferrous and the copper ammonium carbonate test when the basis metal is copper or brass. The porosity tests are described in full and complete instructions are given for using them.

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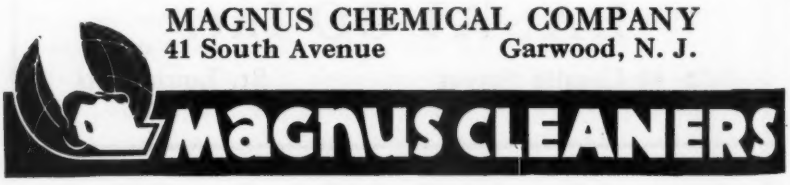

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Membership Report

To August 1, 1937

ELECTIONS

Patrick Vitello, 85 Harpers Ferry Rd., Waterbury, Conn.
Associate, Waterbury Branch

A. J. Lemrise, 850 W. 50th Pl., Chicago, Ill.
Active, Chicago Branch

Joseph Cerceo, 814 S. Kilbouren Ave., Chicago, Ill.
Active, Chicago Branch

Lloyd Keiser, 2231-7th St., Rockford, Ill.
Active, Chicago Branch

Oscar Henninger, 1939 Lincoln Ave., Chicago, Ill.
Active, Chicago Branch

Orville Kocour, 4724 S. Turner Ave., Chicago, Ill.
Associate, Chicago Branch

Morton C. Frost, % Frost Co., 6523-14th Ave., Kenosha, Wis.,
Associate, Milwaukee Branch

Louis O. Jorgensen, % Frost Co., 6523-14th Ave., Kenosha, Wis.
Active, Milwaukee Branch

Walter B. Atkinson, West Bend, Wis.
Active, Milwaukee Branch

Henry C. Stewart, 1714 Beverley Rd., Milwaukee, Wis.
Associate, Milwaukee Branch

J. G. McCallum, Marchant Calc Mac Co., Oakland, Calif.
Associate, San Francisco Branch

William C. Jacobson, 5690 San Pablo Ave., Oakland, Calif.
Active, San Francisco Branch

APPLICATIONS

H. W. Conn, 2111-49th Court, Cicero, Ill.
Associate, Chicago Branch

E. W. Van Goethem, 4721 W. 19th St., Cicero, Ill.
Associate, Chicago Branch

T. J. Walther, 1027 W. Van Buren St., Chicago, Ill.
Associate, Chicago Branch

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"Insist on McAleer's"

SUSPENSIONS

Willis Harvey, R. R. No. 2, Byron Center, Mich.
Grand Rapids Branch

Alvin Collins, 1904 Clyde Park Ave., Grand Rapids, Mich.
Grand Rapids Branch

William J. Chambers, 262 Douglas St., Jackson, Mich.
Grand Rapids Branch

Carl Debler, 833 Arch St., Philadelphia, Penna.
Philadelphia Branch

M. Dumsha, 5013 Melrose St., Philadelphia, Pa.
Philadelphia Branch

J. L. Dinan, 249 Wembly Rd., Upper Darby, Penna.
Philadelphia Branch

A. Fleming, 2963 N. Fairhill St., Philadelphia, Penna.
Philadelphia Branch

J. M. Kreider, Neffsville, Lancaster, Penna.
Philadelphia Branch

Geo. H. Shappel, 222 S. 4th St. Hamburg, Penna.
Philadelphia Branch

H. C. Simmons, 219 Pryos St., Atlanta, Ga.
Philadelphia Branch

REINSTATEMENT

C. R. Kelley, 601 Garfield Ave., Elkhart, Ind.
Active, Chicago Branch

RESIGNED

George E. Hopkins, Waterbury, Conn. Bridgeport Branch

POSITION WANTED

Chemical Engineer (U. of Michigan '23) 4 years of Laboratory work. 3 years as plating chemist, have had charge of all electroplating work in large automobile concern in Michigan, well recommended. Locality makes no difference.

Address reply, 90 Maynard St., Springfield, Mass.

POSITION by PLATER and POLISHER WANTED

Position or job wanted by a member of the A.E.S., who desires to make a change. Has had experience as foreman plater and polisher in hardware and chrome plated furniture plants, also job shop work.

Address, 90 Maynard St., Springfield, Mass.

INFORMATION WANTED

A member from Manila, P. I., writes: We are interested in steel piping for manufacturing chrome steel furniture. Information regarding the proper materials and who can export same will be very much appreciated by us.

Address, Exec. Sec., 90 Maynard St., Springfield, Mass.